IMPACT OF A RESALE PRICE INCREASE ON JAPAN'S WHEAT IMPORTS

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ABSTRACT

An econometric model isolated the impact of a resale price increase on Japan's wheat imports. It predicts that with other factors held constant, the 16.4-percent increase in the Japanese Government's resale price of wheat as of July 1, 1976, would cost the United States $30 million in lost sales of wheat to Japan during July 1976-June 1977.

KEYWORDS: Forecasting, Japan, short run, trade, wheat.

FOREWORD

This study describes an econometric model to estimate the effects of changes in quantifiable determinants on Japan's wheat imports—one part of the process of making short term forecasts of U.S. agricultural exports to Japan. The resulting information is being used along with analysis of other factors affecting Japan's wheat imports to arrive at the official U.S. Department of Agriculture forecast, which is published periodically in *Foreign Agricultural Circular: Grains*. The results of the present study are published to isolate only the effect on imports of the recent increase in the Japanese resale price of wheat.

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SUMMARY

The Japanese Government raised the resale price of imported wheat by 16.4 percent on July 1, 1976. This study estimates the parameters of a wheat consumption function using an econometric model. With other factors held constant, the model predicts the volume of Japan's wheat imports in the short term at the latest resale price. This volume is then compared with what the volume would have been if the resale price had remained at the previous level, set on January 20, 1976.

Results of the model are that the price increase of July 1, 1976, would lower wheat imports during July 1976-June 1977 by 300,000 metric tons. Assuming that the U.S. share of the loss in sales would be equal to the U.S. share of Japan's total wheat imports, the dollar loss to U.S. exporters would be about $30 million (at U.S. average f.o.b. prices for U.S. fiscal year 1975/76).

IMPACT OF A RESALE PRICE INCREASE ON JAPAN'S WHEAT IMPORTS

By Bruce L. Greenshields [1]

INTRODUCTION

Japan is an important market for U.S. wheat exports. In U.S. fiscal year 1975/76, U.S. sales of wheat to Japan amounted to 3.3 million metric tons and were valued at $543 million, 11 percent of total U.S. wheat exports.

The Japanese Government directly controls wheat imports as part of its policy to provide staple foods to Japanese consumers at relatively low prices. The Government sets the prices at which imported and domestic wheat are resold to millers, as well as the price at which the domestic crop is purchased (*8*)[2]. These prices determine the volume of imports, as can be seen in figure 1. Price P_2 is the support price for domestic wheat which generates the production volume of Q_2. Price P_3 is the average Government resale price of domestic and imported wheat paid by millers who demand the total volume of Q_3 at that price. The amount imported is $Q_3 - Q_2$.

The wheat pricing decisions depend to a large extent on rice policies, because rice and wheat products are close substitutes in the Japanese diet. At present the rice policies are aimed at maintaining a total rice consumption which is constant (thus implicitly allowing for a 1.4-percent annual decline in per capita consumption because of population growth) and equal to domestic production. The desire of the Japanese Government is to maintain rice consumption in order to limit dependence on imported food (and feed).

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[1]Greenshields is an economist in the Foreign Demand and Competition Division of the Economic Research Service. Alan S. Brigida, a Federal junior fellow and student at the College of William and Mary in Williamsburg, Virginia, helped in the research for this report.

[2]Italicized numbers in parentheses refer to references listed at the end of this report.

Japan: Hypothetical Wheat Demand and Supply Curves

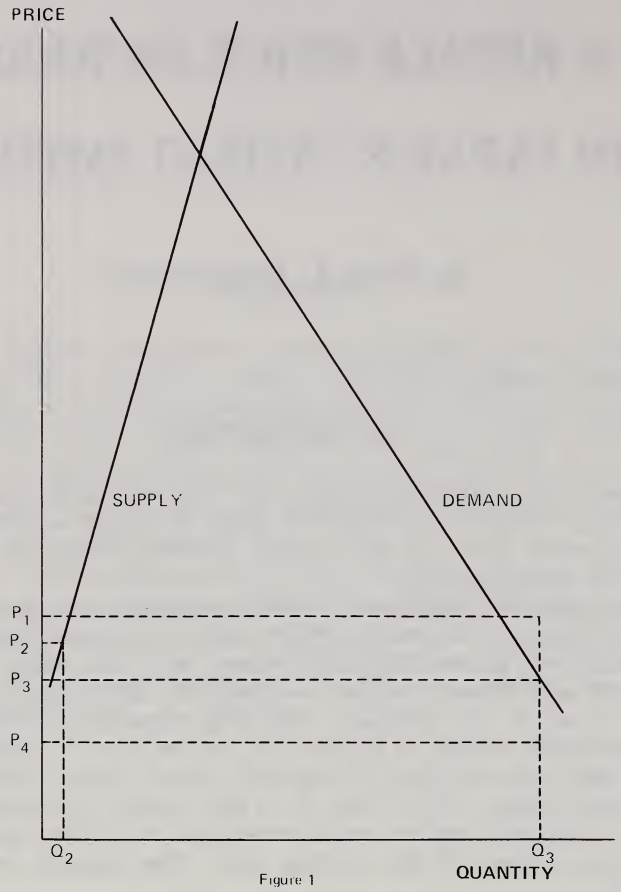

Figure 1

Rice prices are also administered by the Government, and because rice and wheat products are substitutes, the rice price is a wheat demand shifter. An increase in the rice price, *ceteris paribus*, will shift the wheat demand curve (fig. 1) to the right, thus increasing the volume of wheat imports. Likewise, a decrease in the rice price, *ceteris paribus*, will shift the wheat demand curve to the left, thus decreasing the volume of wheat imports. Therefore, the Government-administered wheat and rice prices jointly determine wheat imports, together with the other traditional determinants of wheat supply and demand.

The Government resale price of imported wheat until 1973 has been higher than the landed price in Japan—at times by as much as 50 percent. This tax, or "skimming," as it is often called, had been used to help finance the differences between the purchase and resale prices of domestic wheat and rice. It had also been used to defray the administrative costs of purchasing and handling the imported wheat. But during 1973-75, the landed price in Japan exceeded the resale price, at times by as much as a half, in effect constituting an import subsidy. This situation was allowed to prevail because of the Government's efforts to curb retail price increases at that time.

The effects of the subsidy or tax can be seen graphically in figure 1. If the world price is P_1 and the resale price is P_3, the import subsidy is $P_1 - P_3$ per unit, or equal to the total value of $P_1(Q_3 - Q_2) - P_3 (Q_3 - Q_2)$. Likewise, if the world price is P_4 and the resale price is P_3, the import tax is $P_3 - P_4$ per unit, or equal to the total value of $P_3 (Q_3 - Q_2) - P_4 (Q_3 - Q_2)$.

The change in the wheat resale price which occurred on July 1, 1976, put the resale price about a fifth greater than the landed price. The average increase for all imported wheat was 16.4 percent over the resale price which has been in effect since January 20, 1976. For U.S. Western White No. 2, the increase was 14 percent (table 1).

The purpose of this study is to estimate how this latest price change will affect wheat imports in the short run.

Table 1—Japan: Government resale price of U.S. Western White #2

Japanese fiscal year	April	May	June	July	August	September	October
	Yen per metric ton[1]						
1960/61	35,910	35,910	35,910	35,910	35,910	35,910	35,910
1961/62	35,910	35,910	35,910	35,450	35,450	35,450	35,450
1962/63	35,450	35,450	35,450	35,200	35,200	35,200	35,200
1963/64	35,200	35,200	35,200	35,200	35,200	35,200	35,200
1964/65	35,200	35,200	35,200	35,200	35,200	35,200	35,200
1965/66	35,200	35,200	35,200	35,200	35,200	35,200	35,200
1966/67	35,200	35,200	35,200	34,920	34,920	34,920	34,920
1967/68	34,920	34,920	34,920	34,640	34,640	34,640	34,640
1968/69	34,640	34,640	34,640	34,650	34,650	34,650	34,650
1969/70	34,650	34,650	34,650	34,460	34,460	34,460	34,460
1970/71	34,460	34,460	34,460	34,460	34,460	34,460	34,460
1971/72	34,460	34,460	34,460	34,530	34,530	34,530	34,530
1972/73	34,530	34,530	34,530	33,690	33,690	33,690	33,690
1973/74	33,690	33,690	33,690	33,690	33,670	33,670	33,670
1974/75	45,760	45,760	45,760	45,760	45,250	45,250	45,250
1975/76	45,250	45,250	45,250	45,250	45,200	45,200	45,200
1976/77	53,220	53,220	53,220	60,660	60,660	60,660	60,660

Footnote at end of table.

Continued—

Table 1—Japan: Government resale price of U.S. Western White #2—continued

Japanese fiscal year	November	December	January	February	March	Average
	Yen per metric ton[1]					
1960/61	35,910	35,910	35,910	35,910	35,910	35,910
1961/62	35,450	35,450	35,450	35,450	35,450	35,565
1962/63	35,200	35,200	35,200	35,200	35,200	35,263
1963/64	35,200	35,200	35,200	35,200	35,200	35,200
1964/65	35,200	35,200	35,200	35,200	35,200	35,200
1965/66	35,200	35,200	35,200	35,200	35,200	35,200
1966/67	34,920	34,920	34,920	34,920	34,920	34,990
1967/68	34,640	34,640	34,640	34,640	34,640	34,710
1968/69	34,650	34,650	34,650	34,650	34,650	34,648
1969/70	34,460	34,460	34,460	34,460	34,460	34,508
1970/71	34,460	34,460	34,460	34,460	34,460	34,460
1971/72	34,530	34,530	34,530	34,530	34,530	34,513
1972/73	33,690	33,690	33,690	33,690	33,690	33,900
1973/74	33,670	45,760	45,760	45,760	45,760	37,707
1974/75	45,250	45,250	45,250	45,250	45,250	45,420
1975/76	45,200	45,200	45,200	53,220	53,220	46,553
1976/77	60,660	60,660	60,660	60,660	60,660	58,880

[1]Excluding bagging cost (1,090 yen per metric ton in 1975/76) and contract production bounty (600 yen per metric ton in 1975/76).

Source: Government of Japan, Ministry of Agriculture and Forestry, Food Agency.

METHOD OF ANALYSIS

Wheat imports are determined by the demand for wheat and the domestic supply of wheat, as shown in figure 1. At any particular price, the total quantity supplied is equal to domestic production plus imports, and the total quantity demanded is equal to consumption plus exports plus the change in stocks, giving the following identities:

Equation 1

$$QS = Y + M$$

Equation 2

$$QD = C + X + \Delta S$$

Equation 3

$$QS = QD$$

Equation 4

$$Y + M = C + X + \Delta S$$

Equation 5

$$M = C + X + \Delta S - Y$$

Where:

QS	=	Quantity supplied
Y	=	Domestic production
M	=	Imports
QD	=	Quantity demanded
C	=	Consumption
X	=	Exports
ΔS	=	Change in stocks

Observed values of these variables are given in table 2 for Japanese fiscal years (April-March) 1960/61-1975/76. The quantity supplied is predominantly imports in recent years. Exports are relatively insignificant, as are changes in stocks, relative to consumption.

A structural equation is used to describe and predict the demand for wheat for consumption, and the other variables on the right side of equation 5 are exogenous. Thus, the values for X, ΔS, and Y are predicted on the basis of any available information, such as planting intentions and stock policies.

Table 2—Japan: Wheat quantities supplied and demanded

Japanese fiscal year	Quantity supplied (QS)		Quantity demanded (QD)			Total demanded and supplied (QS = QD)
	Production (Y)	Imports (M)	Consumption (C)	Exports (X)	Change in stocks (ΔS)	
	1,000 metric tons					
1960/61	1,531	2,660	3,965	47	179	4,191
1961/62	1,781	2,660	4,190	71	180	4,441
1962/63	1,631	2,490	4,272	93	-244	4,121
1963/64	716	3,412	4,290	73	-235	4,128
1964/65	1,244	3,471	4,505	68	142	4,715
1965/66	1,287	3,532	4,631	88	100	4,819
1966/67	1,024	4,103	4,983	79	65	5,127
1967/68	997	4,238	5,106	87	42	5,235
1968/69	1,012	3,996	5,092	114	-198	5,008
1969/70	758	4,537	5,245	81	-31	5,295
1970/71	474	4,621	5,207	47	-159	5,095
1971/72	440	4,726	5,206	55	-95	5,166
1972/73	284	5,317	5,372	56	173	5,601
1973/74	202	5,369	5,498	38	35	5,571
1974/75	232	5,485	5,517	26	174	5,717
1975/76	241	5,726	5,732	35	200	5,967

Source: Government of Japan, Ministry of Agriculture and Forestry, *Food Balance Sheet,* annual issues, except for 1975/76 which is estimated based on actual trade and production from: Ministry of Finance, *Japan Exports and Imports,* various monthly issues; and Ministry of Agriculture and Forestry, *Monthly Statistics of Agriculture, Forestry, and Fisheries,* June 1976.

Wheat consumption is mainly a function of the wheat price, population, income, the price of close substitutes, and consumer preferences, such that:

Equation 6

$$C = f(P, POP, I, SUB, T)$$

Where:

P	=	Wheat price
POP	=	Population
I	=	Income
SUB	=	Price of close substitutes
T	=	Consumer preferences

The approach is to estimate the parameters of the function (equation 6) and to predict the volume of imports in the short term at the latest resale price. This volume is then compared to what the volume would have been if the resale price had remained at the previous level, set on January 20, 1976.

RESULTS OF THE STATISTICAL ANALYSIS

The functional relationship (equation 6) is specified as linear in equation 7. The coefficients are estimated by ordinary least squares regression analysis. The sample period is Japanese fiscal years 1960/61-1975/76. Data used in the wheat consumption function are given in table 3. The equation and its estimated coefficients are as follows:

Equation 7

$$C/POP = 77.8008 - 0.6448(P/IPD) - 17.9667\,[(I/IPD)/POP]$$
$$(0.1454) \qquad (6.7900)$$
$$(4.4334) \qquad (2.6460)$$
$$(0.9992) \qquad (0.9787)$$

$$+\ 0.0579\,(SUB/IPD)$$
$$(0.0291)$$
$$(1.9853)$$
$$(0.9296)$$

Where:

C/POP	=	Wheat consumption per capita, kilograms per person
P/IPD	=	Real wheat price (resale price of U.S. Western White No. 2/GNP implicit price deflator), yen per kilogram
(I/IPD)/POP	=	Real GNP per capita, million yen per person
SUB/IPD	=	Real rice price (resale price of domestic rice/GNP implicit price deflator), yen per kilogram, brown basis

The standard errors of the beta coefficients are in parentheses under the coefficients. The "t" statistics are in parentheses under the standard errors. The levels of significance of the beta coefficients are in parentheses under "t" statistics.

Other statistics of the equation are:

Coefficient of determination (R^2) = 0.91
Standard error of the estimate = 0.9485
Mean of the dependent variable = 48.2991
Coefficient of variability (percent) = 1.96
Durbin-Watson (d) = 1.50

The derived demand elasticities, measured at the means of the variables, are:

Price (P/IPD)	=	-0.54
Income [(I/IPD)/POP]	=	0.21
Cross price (SUB/IPD)	=	0.14

Table 3—Japan: Variables in the wheat consumption function

Japanese fiscal year	Consumption (C)	Wheat resale price (P)	Population (POP)	Income (I)	Rice resale price (SUB)
	1,000 metric tons	*Yen per metric ton*	*Million persons*	*Billion yen*	*Yen per metric ton*
1960/61	3,965	35,910	93.419	16,207	72,520
1961/62	4,190	35,565	94.287	19,853	72,100
1962/63	4,272	35,263	95.181	21,660	71,900
1963/64	4,290	35,200	96.156	25,592	80,317
1964/65	4,505	35,200	97.182	29,662	79,717
1965/66	4,631	35,200	98.274	32,814	92,827
1966/67	4,983	34,990	99.036	38,419	101,786
1967/68	5,106	34,710	100.196	45,297	100,750
1968/69	5,092	34,648	101.331	53,288	115,617
1969/70	5,245	34,508	102.536	62,260	124,950
1970/71	5,207	34,460	104.665	73,046	124,027
1971/72	5,206	34,513	106.093	81,577	122,947
1972/73	5,372	33,900	107.589	94,729	126,357
1973/74	5,498	37,707	109.102	115,605	130,100
1974/75	5,517	45,420	110.573	136,339	150,217
1975/76	5,732	46,553	111.934	149,092	189,882

Sources at end of table.

Continued—

Table 3—Japan: Variables in the wheat consumption function—continued

Japanese fiscal year	Implicit price deflator (IPD)	Per capita consumption (C/POP)	Real wheat resale price (P/IPD)	Per capita real income [(I/IPD) POP]	Real rice resale price (SUB/IPD)
	Calendar year 1970 = 1,000	*Kilograms per person*	*Yen per kilogram*	*Million yen per person*	*Yen per kilogram*
1960/61	619	42.4432	58.0129	0.280270	117.157
1961/62	668	44.4388	53.2410	0.315208	107.934
1962/63	685	44.8829	51.4788	0.332214	104.964
1963/64	719	44.6150	48.9569	0.370168	111.707
1964/65	754	46.3563	46.6844	0.404803	105.725
1965/66	789	47.1233	44.6134	0.423198	117.651
1966/67	831	50.3150	42.1059	0.466823	122.486
1967/68	867	50.9601	40.0346	0.521435	116.205
1968/69	905	50.2512	38.2851	0.581083	127.754
1969/70	952	51.1528	36.2479	0.637817	131.250
1970/71	1,013	49.7492	34.0178	0.688947	122.435
1971/72	1,054	49.0702	32.7448	0.729525	116.648
1972/73	1,115	49.9308	30.4036	0.789660	113.325
1973/74	1,278	50.3932	29.5047	0.829112	101.800
1974/75	1,510	49.8946	30.0795	0.816571	99.481
1975/76	1,602	51.2087	29.0593	0.831438	118.528

Sources: C — from table 2.
P — from table 1.
POP — Office of the Prime Minister of Japan, *Monthly Statistics of Japan*, Apr. 1976.
I and IPD — Economic Planning Agency, *Annual Report on National Income Statistics*, 1976, and *Japanese Economic Indicators*, June 1976.
SUB — Government of Japan, Ministry of Agriculture and Forestry, Food Agency.

Wheat consumption and income are specified in per capita terms, implicitly assuming a population elasticity of 1. This specification is necessary because the simple intercorrelation between population and income is high (0.99), and their separate effects cannot be distinguished if both are included as separate explanatory variables, since they are virtually identical vectors.

The resale price of Western White No. 2 is used to indicate changes in the average resale price for all imported wheats. The Government resale price for the various wheats was based on fixed differentials so that the resale price variation of Western White No. 2 would indicate the average resale price variation of all wheats. The system of fixed differentials only recently has been dropped, but it does not affect the sample. The announced average increase of 16.4 percent is simply an average of the resale prices for all imported wheats—not weighted as to the relative volumes of each type of wheat.

The average resale price of rice is specified as the main substitute price. Consumer preferences are not included as a quantified variable. Gradual shifts in consumer preferences could be handled by including a linear trend variable. But the simple intercorrelation between a linear trend and P/IPD is high (0.99), thus precluding the possibility of isolating the effects of shifts in consumer preferences if there were any in the sample period. In any case, interpreting the trend coefficient would be difficult, because it absorbs most of the unexplained variation of the dependent variable (*3*).

The tracking ability of the model is depicted in figure 2. The predictions made from the equation are given in table 4 for Japanese fiscal year 1976/77 (April-March), U.S. wheat marketing year 1976/77 (June-May), Japanese wheat marketing year 1976/77 (July-June), and U.S. fiscal year 1976/77 (October-September). Predictions are based on the resale price that became effective on January 20, 1976 (I), and on the resale price that became effective on July 1, 1976 (II), which is assumed unchanged throughout the forecast period. Only P is allowed to vary, and thus the difference between imports under I and II is attributable to the price increase.

Whatever values are estimated for X, ΔS, and Y are immaterial to the purpose of this paper as they do not affect the difference between I and II. POP is estimated based on an annual growth rate of 1.4 percent. I and IPD are based on projections by the Japan Economic Research Center (*5*). SUB is based on the actual resale price which was raised by 10.2 percent on September 1, 1976 (the previous price had been in effect since September 1, 1975), and SUB assumes no change throughout the forecast period.

Japan: Wheat Consumption Per Capita

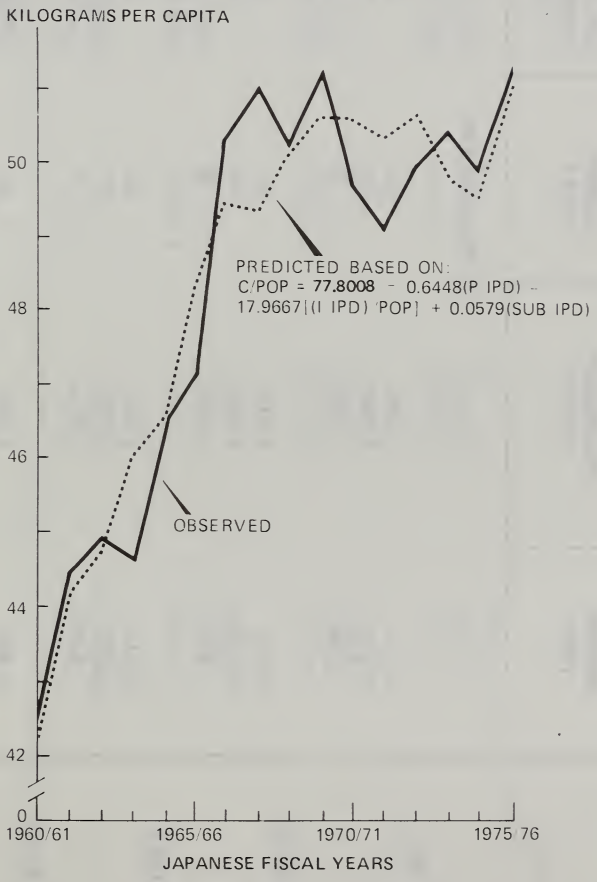

Figure 2

Table 4—Japan: Wheat import predictions

Year[1]	Imports (M)	Consumption (C)	Exports (X)	Change in stocks (ΔS)	Production (Y)
	1,000 metric tons				
Apr. 1976/Mar. 1977:					
I	5,478	5,594	25	100	241
II	5,236	5,352	25	100	241
I – II	242	242	0	0	0
June 1976/May 1977:					
I	5,500	5,616	25	100	241
II	5,213	5,329	25	100	241
I – II	287	287	0	0	0
July 1976/June 1977:					
I	5,515	5,631	25	100	241
II	5,201	5,317	25	100	241
I – II	314	314	0	0	0
Oct. 1976/Sept. 1977:					
I	5,542	5,658	25	100	241
II	5,233	5,349	25	100	241
I – II	309	309	0	0	0

Footnote at end of table.

Continued—

Table 4—Japan: Wheat import predictions—continued

Year[1]	Wheat resale price (P)	Population (POP)	Income (I)	Rice resale price (SUB)	Implicit price deflator (IPD)
	Yen per metric ton	*Million persons*	*Billion yen*	*Yen per metric ton*	*Calendar year 1970 = 1,000*
Apr. 1976/Mar. 1977:					
I	53,220	113.501	170,185	215,531	1,711
II	58,880	113.501	170,185	215,531	1,711
I – II	–5,660	0	0	0	0
June 1976/May 1977:					
I	53,220	113.766	176,432	218,992	1,741
II	60,040	113.766	176,432	218,992	1,741
I – II	–6,820	0	0	0	0
July 1976/June 1977:					
I	53,220	113.898	176,432	220,722	1,741
II	60,660	113.898	176,432	220,722	1,741
I – II	–7,440	0	0	0	0
Oct. 1976/Sept. 1977:					
I	53,220	114.296	182,961	224,183	1,771
II	60,660	114.296	182,961	224,183	1,771
I – II	–7,440	0	0	0	0

[1]See text for explanations of I and II.

RELATED RESEARCH IN ERS

A wheat demand equation was estimated by Rojko (*6*) on a relatively short time series sample of 11 annual observations (1957-67). As in the present study, the rice price was significant. The beta coefficient on income was positive in Rojko's equation and consistent with his expectations at that time. But Hashimoto (*7*), whose study[3] was partly financed by the Economic Research Service (ERS), estimated Rojko's equation (same variables and functional forms) with a time series sample of 19 observations (1955-73). He found the beta coefficient on income to be insignificant. Hashimoto also estimated a demand function with the same variables and functional form as in the present study, but then he proceeded to drop income from the specification because of an insignificant beta coefficient. One possible explanation for Hashimoto's difficulty with the income variable is his treatment of the data. He has some unintended partial lags in his equation because he deflated prices, which were averaged over April-March years (Japanese fiscal years), by the calendar year consumer price index; his real income variable was on a calendar year basis; his population variable was midyear of the Japanese fiscal year; and his consumption variable was on a Japanese fiscal year basis. In the present study, all variables are Japanese fiscal year averages, including the price deflator.

Another earlier ERS study (*4*) contains an equation to estimate Japan's wheat import demand, and the specification in the present study represents a refinement in that the explanatory variables are separated into those that are predicted stochastically and those that are predicted from a deterministic model. The earlier model (*4*) was a nonlinear equation, and that specification was tested on the sample used in the present study. It was concluded that the improvement in the fit was not enough to merit using the complication of logarithmically transforming the data.

An ERS model of the U.S. wheat sector is being developed that includes an endogenous treatment of the export sector (*2*). This model contains a demand equation with Japan's per capita imports of U.S. wheat specified as the dependent variable. The explanatory variables are Japanese wheat production plus beginning stocks, real per capita income, real resale price of Western White No. 2, and a dummy variable for U.S. dock strikes—a major determinant in the historical variation in the U.S. share of the Japanese market.

Finally, ERS is having a study prepared in cooperation with Wheat Associates, U.S.A. (*1*), which will fully detail how the resale price of wheat is determined, including such factors as the relative importance of the rice price, the international wheat price, and Japanese economic objectives. This study should be completed and published by ERS in 1977.

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[3]Takayama is the principal author, but the chapter on Japan was written by Hashimoto.

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Appendix table 1—Japan: Exchange rates

Year	Rate
	Yen per U.S. dollar
Calendar years:	
1960–70	360.00
1971	350.74
1972	308.00
1973	292.19
1974	291.51
1975	296.80
Japanese fiscal years:	
1960–70	360.00
1971	337.80
1972	302.03
1973	274.24
1974	291.77
1975	299.07

Source: International Monetary Fund, *International Financial Statistics*, various monthly issues.

Appendix table 2—Japan: Wheat imports by country of origin

Year	Wheat imports					Share of wheat imports			
	Total	United States	Canada	Australia	Other	United States	Canada	Australia	Other
	1,000 metric tons					*Percent*			
1960	2,678	981	1,326	307	64	37	50	11	2
1961	2,631	798	1,459	355	19	30	55	13	1
1962	2,562	880	1,207	446	30	34	47	17	1
1963	3,178	1,452	1,303	382	41	46	41	12	1
1964	3,592	1,681	1,400	484	27	47	39	13	1
1965	3,645	1,971	1,249	422	3	54	34	12	0
1966	3,917	2,158	1,387	372	0	55	35	9	0
1967	4,130	2,186	1,436	507	1	53	35	12	0
1968	4,073	2,072	1,241	748	12	51	30	18	0
1969	4,328	1,986	1,015	1,245	82	46	23	29	2
1970	4,685	2,586	1,195	903	1	55	26	19	0
1971	4,872	2,563	1,246	1,063	0	53	26	22	0
1972	5,148	2,545	1,236	1,367	0	49	24	27	0
1973	5,386	3,616	1,450	183	137	67	27	3	3
1974	5,377	3,025	1,488	830	34	56	28	15	1
1975	5,654	3,004	1,476	1,174	0	53	26	21	0

Source: Japan Customs Bureau, Ministry of Finance.

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